

## **SPEECH THERAPY CLINICAL STUDY**

### **Speech Involvement in Healthy Adults Oral-Motor Physiological Effects of an 8-Week Mechanically Aided Resistance Exercise Program**

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#### **ABSTRACT**

This paper describes a study on the physiological effects of an 8-week mechanically aided exercise program using the Facial-Flex® device (Facial Concepts, Inc.) with 4 healthy normal-speaking subjects. Using a variety of non-speech and speech tasks, we collected information on upper and lower lip muscle activity (EMG) and single and coordinated patterns of upper and lower lip movements at 2 baseline (BL) sessions and immediately after (POST) the 8-week training period. During that period, subjects exercised with the device twice a day for 50 repetitions each using a fixed resistance of 6 ounces.

The results indicated that after the training period, performance on the Facial-Flex® task had increased as assessed by the Linebaugh tests. Regarding the physiological response, the normalized EMG output on average had increased for both the non-speech and speech tasks, but the effect was stronger for the former. Furthermore, subjects showed an increase in movement duration for lip closing, paralleled by a decrease in kinematic stiffness and an increase in velocity profile parameter (VPP) values. Task effects were also found, in that non-speech lip movements were clearly different from speech-related lip movements, showing longer durations and less stable movement and coordination patterns. In addition, the more complex speech tasks (3-syllable sequences), compared to the other speech tasks (1 and 2 syllables), showed smaller and faster lip closing movements with less stable movement and coordination patterns. Together, these task effects suggest that both non-speech and complex speech tasks put higher (although different) demands on the speech motor system.

#### **CONCLUSION**

In general, the data of this study support the claim that the use of the Facial-Flex® device has a clear impact on speech-motor physiology and when embedded in a broader orofacial treatment approach may provide a valuable tool to improve facial muscle strength.

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#### **Treating Voice Disorders**

#### **The Use of Facial-Flex® as an Adjunct to Speech Therapy in the Treatment of Voice Disorders:**

#### **A Case Report**

*By Joseph R. Spiegel, M.D., Judith N. Creed, M.A., CCC-SLP, Kate A. Emerich, M.S., CCC-SLP*

#### **INTRODUCTION**

Facial-Flex® is a lightweight, mouthpiece-sized device which provides dynamic resistance



during oral motor exercises. It has been shown to strengthen the circumoral facial muscles when used in a program to maintain constant resistance with daily use. Facial-Flex® is currently under study as an adjunct to speech therapy in patients with disorders of both muscular weakness and hyperfunction that affect voice. The following case report demonstrates early results in a patient with both of these problems.

### **CASE REPORT**

The patient is a 57-year-old male with a 4- to 5-month history of hoarseness, hypernasality and strain with voice use. Otolaryngologic examination including stroboscopy revealed a right superior laryngeal nerve paresis, muscle tension dysphonia and gastroesophageal reflux laryngitis. He was referred for speech therapy evaluation and treatment.

Initial examination of the oral mechanism revealed slight weakness of the lips and circumoral muscles on the left side, slight left-sided tongue weakness and spasms of the left neck and cheek. During conversational speech and reading passage, throat, jaw and tongue tension was evident and placement of the tongue was generally posterior. His vocal quality was slightly hoarse.

The patient completed an 8-week course of therapy, including 4 biweekly, 30- to 45-minute speech therapy sessions and exercise with the Facial-Flex®. He successfully progressed from 60 repetitions daily with 6 ounce resistance to 300 repetitions daily with 8 ounce resistance during the study period. At the completion of the therapy course both the patient and the therapist noted complete resolution of the asymmetric left facial weakness and of the cheek and neck spasms. Questionnaires completed by both patient and therapist separately reveal that they both felt that the Facial-Flex® made the speech therapy easier to complete and more successful. The patient has had improvement in vocal quality, strength stamina, pitch range and ease of use.

### **DISCUSSION**

This is a single case report of the subjective findings of a therapist and patient with regard to use of Facial-Flex® as an adjunct to a program of speech therapy. These early results are exciting because they demonstrate the safe and efficacious use of Facial-Flex® in a patient with voice problems secondary to both muscle weakness and compensatory muscle tension.

Voice disorders result from a variety of local and systemic conditions. Some patients have poor vocal quality or strength due to lesions such as a laryngeal neoplasm or injury, neuromuscular weakness, voice abuse or psychological stress. Diseases of neuromuscular weakness, abnormal muscle motion and disorders of central neurologic control can cause poor speech articulation and weak voice quality.

Many voice disorders are associated with a weakness, incoordination or abnormal use of facial and cervical muscles. Normal voice production requires movement and stabilization of the larynx by the extrinsic laryngeal muscles in the neck. The facial musculature is affected as an extension of the cervical muscles and is a primary component in the formation of language. Tone of the facial and cervical muscles also has an influence on vocal resonance in the oral cavity and pharynx. Weakness of these muscle groups may result in complaints such as hoarseness, breathiness, loss of vocal volume, loss of pitch range, vocal fatigue dysarthria and slurred speech. Conditions causing such weakness include cerebrovascular accident (stroke), chronic neuromuscular diseases (e.g., multiple sclerosis, ALS), myasthenia gravis, surgical trauma, Bell's palsy and any chronic debilitating disease.

Speech therapy provided by a speech-language pathologist trained in voice care and singing voice training provided by a voice teacher is beneficial in the treatment of almost all patients with disorders of voice secondary to related neuromuscular dysfunction. Strengthening exercises are utilized to correct weakened muscle groups and provide balanced muscular



effort. Specific exercises and maneuvers are taught to promote relaxation in muscle groups with demonstrated hyperfunction. Additionally, the promotion of general vocal hygiene and proper speaking and singing technique will result in more balanced and proper use of the cervicofacial muscles.

Facial-Flex® is an adjunct to speech therapy for all disorders of cervicofacial muscle strength or spasm causing dysphonia.

1. Grove GL, Rimdzius SW, Grove MJ. Changes in facial skin biomechanics due to a mechanically aided resistance exercise program. *Clinical Research*, 40(2):442, 1992.
2. Grove GL, Rimdzius SW, Zerweck CR. A mechanically aided resistance exercise program for sagging facial muscles. *Journal of Geriatric Dermatology*, 2(5):152-158, 1994.

### **Physical Rehabilitation**

### **Recovery of Facial Muscle Strength in the Disabled Through a Mechanically Aided Resistance Exercise Program**

*By Judith Creed, M.A., CCC, SLP, Joseph R. Spiegel, M.D., Jesse Selber, B.A.*

### **INTRODUCTION**

Physical rehabilitation is principally comprised of movement through an appropriate range of motion, most often opposed by varying specific levels of resistance. The primary objective of the therapy is to improve function and regain maximum range of motion and strength within the circumstances of any specific disability. Physical rehabilitation of craneo-oral facial disabilities, including disorders of the throat, is generally performed by a physical therapist or speech-language pathologist. Such therapy is often performed in conjunction with treatment by an attending physician, depending upon the etiology and severity of the disability. Craneo-facial therapy often incorporates some form of resistance to movement. The practice of speech-language pathology for the improvement of oral-facial motor function is typically centered on resistance-based, oral-motor muscle exercise. Current practice employs a variety of relatively crude devices to apply this resistance. These include whistles, tongue depressors, fingers, etc. Until recently, there has been no device which provides constant, dynamic external resistance during exercise of oral-motor musculature. Absent such a device, there is no controllable level of resistance that can be applied during therapy. Therefore, range of motion exercises go unopposed by dynamic external resistance, and outcomes are unquantifiable.

Facial-Flex® is a lightweight, mouthpiece-size device, which provides external dynamic resistance during oral-motor exercises. As a rehabilitation instrument, Facial-Flex® satisfies all the criteria that have, until now, been absent from exercise programs for the oral musculature. Either the patient or the therapist can set the specific level of resistance, so the patient can take the therapy home and work independently of a therapist. Constant, dynamic external resistance opposes the full range of motion during oral motor exercise. Changes in oral muscle strength can be precisely and objectively quantified by measuring changes in a patient's ability to perform an exercise against a specific level of resistance.

The efficacy of Facial-Flex® has already been firmly established in use on healthy individuals to improve facial muscle tone (Grove, Rimdzius, Grove 1992 and Grove, Rimdzius, Zerweck 1994). Because of its effectiveness, more than 1,000,000 Facial-Flex® products have been sold in the aesthetics market in 12 years. There is every reason to believe Facial-Flex® would be effective in the rehabilitation of patients with disabilities affecting the oral-facial musculature. Many disorders, such as cerebrovascular accidents, traumatic brain injury, CNS diseases such as Parkinson's and developmental diseases, can all cause loss of oral-facial strength and control, resulting in dysarthria, oral dysphagia and hypomimia. The importance



of facial expressions and speaking and eating in everyday human experience cannot be overemphasized.

The following is a preliminary and informal presentation of findings in 3 residents of a skilled nursing facility. Each patient had a baseline measure of oral-facial muscle strength using Facial-Flex®. The strength level is determined by having the patient repeat the exercise using Facial-Flex® until the point of muscle fatigue. To disambiguate the effect of other therapy from the use of Facial-Flex®, no other exercises of the oral-facial musculature were employed during the trial period. The therapy period lasted for 3 weeks. During that time, the patients were treated 3 times a week, twice a day by a speech-language pathologist.

#### **CASE 1: LEFT CEREBROVASCULAR ACCIDENT**

The first patient is a 90-year-old female who suffered a left middle cerebral vascular occlusion. Baseline was established 1 month after the patient suffered her stroke. Speech-language pathology diagnosed the patient as dysarthric, with weak bilabial phonemes. There was difficulty maintaining oral muscular form to articulate the vowels 'p' and 'b'. The patient also experienced oral dysphagia, with interior leakage of solids and liquids. A right facial droop was evident. Baseline facial strength was measured by the number of repetitions performed with the Facial-Flex® device. This patient was able to complete 7 repetitions.

At the end of the 3-week exercise period, the patient had moved from 7 repetitions to 40 repetitions. Dysarthria on bilabials had abated. The patient had no trouble articulating 'p' and 'b'. During eating and drinking, there was no anterior leakage, and the right facial droop had approached symmetry.

#### **CASE 2: IDIOPATHIC PARKINSONISM**

This patient is an 85-year-old male with idiopathic Parkinsonism. The patient had generalized oral-neurological weakness with hypomimia and dysarthria. Subjective speech-language pathology judged intelligibility at 60%. During the establishment of baseline strength, the patient performed 3 repetitions with Facial-Flex®, with a severe oral action tremor.

At the end of the 3-week exercise period, the patient was able to perform 20 repetitions. Significantly, the action tremor had completely resolved. Speech-language pathology's subjective intelligibility evaluation had increased to 90%.

#### **CASE 3: RIGHT CEREBROVASCULAR ACCIDENT**

This patient is an 80-year-old male who suffered right middle cerebral artery occlusion. Speech-language pathology diagnosis determined oral dysphagia and apraxia characterized by the inability to maintain the oral pucker to sip from a straw. Generalized oral motor weakness was also noted. Baseline evaluation of oral muscle strength was made 1 month after the cerebrovascular accident occurred. The patient was able to perform 5 repetitions at that time. At the completion of the 3-week exercise period, the patient was able to perform 45 repetitions and was able to drink from a straw.

#### **CONCLUSIONS**

The difficulty with a set of informal case studies such as these is that without a control group of stroke patients who had not undergone treatment, it is difficult to judge what is attributable to spontaneous recovery and what is due to the increase in muscle strength as a result of the therapy. One way to get an idea about this, however, is to look at the recovery of the Parkinsonism patient, who should have experienced no spontaneous recovery. The first stroke patient improved the number of repetitions with Facial-Flex® by 571%. The second stroke patient improved in number of repetitions by 900%. The patient with idiopathic Parkinsonism improved by 667%. All these improvements were on the same order of magnitude, suggesting that results gained during the trial therapy period came as a result of the therapy itself and not spontaneous recovery.



Facial-Flex® is a valuable instrument for improving oral muscle strength. It has been proven in published studies on normal patient populations and has experienced great popularity in aesthetic markets for improving oral facial muscle tone. There is no device which ameliorates some of the very devastating disabilities associated with many of the diseases of the CNS which affect the facial musculature. Preliminary findings of this study suggest dramatic rehabilitation of facial musculature in a population for whom such improvement is essential.

### **The Use of Facial-Flex® as an Adjunct to Speech Therapy in Recovery from Extensive Oral Cavity Carcinoma**

*By Joseph R. Spiegel, M.D., Judith N. Creed, M.A., CCC-SLP*

#### **HISTORY**

L.R. is a 74-year-old white female who was diagnosed with a T2NO (stage II) squamous cell carcinoma of the right side of the oral cavity in January 1997. In February 1997, she underwent initial surgical treatment by right marginal mandibulectomy and right supraomohyoid neck dissection. Microscopic metastases were discovered in the neck (stage III) and radiation therapy was completed between the sixth and thirteenth postoperative weeks. She developed recurrent cancer at the primary site that was diagnosed in December 1997; on January 8, 1998, she underwent right hemimandibulectomy and repair with a right fibula osteocutaneous microvascular free flap. She recovered from surgery without complication and, to date, she has been followed without evidence of recurrent cancer.

After initial recovery from the last extensive surgical procedure, L.R. had persistent complaints of difficulty with mouth opening, pain with jaw motion during eating and poor articulation. Her speech difficulty was due to restricted jaw motion, scarring of the right side of the tongue, paresis of the right hypoglossal nerve and paresis of the right marginal mandibular branch of the facial nerve. She also suffered from severe oropharyngeal dysphagia secondary to these lesions and her nutrition was provided primarily by a gastrostomy tube in the postoperative period. After radiation therapy, physical therapy was instituted with gentle jaw exercises and moist heat. Over 8 weeks, L.R. noted only minimal improvement in her articulation. With ongoing swallowing therapy she had progressed to a diet of pureed foods, but she could not tolerate liquids.

Five months postoperatively, L.R. was provided a Facial-Flex® and prescribed an 8-week course of dynamic resistance oral exercise. After 4 weeks, she had progressed to twice-daily exercises with 8-ounce bands. At this point, the protocol was suspended because of persistent pain along the right jaw line. No change in the pain was noted and 3 weeks later the protocol was continued. Over the next 4 weeks of the protocol, L.R. used a once-daily exercise program with 4-ounce bands.

#### **INTERIM RESULTS**

Throughout L.R.'s postoperative course she was under the care of certified speech-language pathologists for both speech therapy for her articulation difficulties and swallowing therapy for oropharyngeal dysphagia. After completing 3 weeks of the first interval of Facial-Flex® use, the patient, her family members, and the treating speech pathologists noted improvement in motion of the right oral commissure and improvement in articulation. As she completed the second interval of Facial-Flex® exercise, L.R. noted significant improvement in articulation and in her swallowing ability. Over this time she regained her capacity to handle a thin liquid diet and her gastrostomy tube was removed. L.R. continues to use Facial-Flex® in a once-daily exercise program as she notes progressive improvement in her jaw pain, mandibular motion and articulation. Close follow-up continues and long term reports of L.R.'s progress will be provided.

**SUMMARY**

This interim report describes a patient with state III carcinoma of the oral cavity requiring extensive surgical resection, complex reconstruction and radiation therapy whose rehabilitation was assisted with an exercise program based on Facial-Flex®. The patient found the device easy to use despite the deformities of her oral and facial structures and there were no complications. The patient has had improvement in speech articulation, oral-motor swallowing function and facial motion. Both the patient and the treating therapists noted these results. This preliminary report supports the use of the Facial-Flex® as an adjunct to physical therapy and speech therapy in a patient undergoing the complex rehabilitative demands in recovery from extensive oral cavity carcinoma.

**Speech Therapy for Children  
Adjunct to Traditional Speech Therapy**

Facial exercise is commonly a component of speech therapy for many different facial muscle disorders. Speech therapists have showed immediate interest in its use in children who require speech therapy for articulation disorders during primary school years. Some children have documented weakness of the circumoral and other facial muscles, and it was hypothesized that those children may show an improved response to traditional speech therapy when an adjunctive exercise is added. Additionally, children with demonstrated coordination problems of these muscle groups may show improved response to speech therapy if a successful program of muscle strengthening is accomplished. As a result, a study was designed to evaluate the safety and efficacy of a dynamic resistant exercise device for children. Each child was monitored by a certified speech-language pathologist and received traditional speech therapy for their disorders.

The study was designed to evaluate the use of both a pediatric and adult model in children, evaluate the efficacy of building facial muscle strength in children using the device and evaluate the result of a short course of progressive resistance exercise on traditional speech therapy for many different articulation disorders.

The devices used in the study utilized mechanical assistance in a program of facial exercise. It provided dynamic resistance to the circumoral muscles and has been shown to strengthen these muscles when used in a program to maintain constant resistance with daily use. Subjects were students in Philadelphia non-public schools with speech services provided by CORA Services, Inc. From a total population of 1,200 children, 201 were selected as potential candidates for study based on the presence of one or more of the following criteria:

- Apraxia
- Suspected weakness and incoordination of oral-motor function
- Poor stimulability for production of early developing phonemes: /p,b,f,v,w,wh,l/
- Poor stimulability for production of two or more targeted phonemes
- Poor stimulability for production of /r/

All children demonstrated improvement of oral motor strength, with an average improvement of 467% in repetition index and 224% in closure time index. Eight children had a significant improvement in articulation after the 8-week study protocol attributable to the use of progressive resistance.

**Using Facial-Flex® to Assist Treatment of Articulation Disorders**

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## ABSTRACT

Facial-Flex® was used as an adjunct to traditional speech therapy in a population of school-age children being treated for articulation disorders. 133 children were chosen from a group of 1,200. Children 10 years and under used the pediatric model and children 11 years and older used the adult model. All subjects were compared to an age-matched control group.

47 children were totally compliant and available for evaluation. All children demonstrated improvement of oral motor strength, with an average improvement of 467% in repetition index and 224% in closure time index. Eight children had a significant improvement in articulation attributable to Facial-Flex® use after the 8-week study protocol.

## INTRODUCTION

A study was designed to evaluate the safety and efficacy of Facial-Flex® in children, to evaluate the usefulness of Facial-Flex® as an adjunct to traditional speech therapy and to compare the adult and pediatric Facial-Flex® appliances. Prior to this study the Facial-Flex® appliance had not been tested for clinical effectiveness in children. The pediatric and adult models of Facial-Flex® were provided to 133 children receiving speech therapy in their school secondary to diagnosed articulation disorders. Each child was monitored by a certified speech-language pathologist and received traditional speech therapy for their disorders. An age-matched control group was constructed for comparison. The study was designed to evaluate the use of both models in children, evaluate the efficacy of building facial muscle strength in children using the device and evaluate the result of a short course of Facial-Flex® use on traditional speech therapy for many different articulation disorders.

## BACKGROUND

The Facial-Flex® appliance is utilized for mechanical assistance in a program of facial exercise. It provides dynamic resistance to the circumoral muscles and has been shown to strengthen these muscles when used in a program to maintain constant resistance with daily use. Facial-Flex® is currently registered as an FDA Class I Medical Device. It can be sold and used as an exercise device without prescription. The device consists of 2 plastic-tipped stainless steel rods which slide across one another. The geometry is such that constant external resistance can be provided throughout the dynamic range by replaceable elastic bands of known resistance. The device is placed horizontally between the upper and lower lips and seated at the corner of the mouth. The user then presses the corners of the lips against the resistance of the device to make a small oval. This position is held for just a second or two, then gently released. After the device has forced the corners of the lips as far apart as possible, the user repeats the compression step. This sequence is repeated for 2 minutes or terminated at muscle fatigue, whichever comes first. After 2 minutes of rest, the entire sequence is repeated for 2 minutes or until muscle fatigue. The Pediatric Facial-Flex® has been developed for smaller mouths and provides a program of progressive dynamic resistance with a series of color-coded devices.

Facial-Flex® provides assistance in a type of facial exercise that is commonly a component of speech therapy for many different articulation disorders. Facial-Flex® was introduced to speech therapists about 1 year ago and there was immediate interest in the use of the device in children who require speech therapy for articulation disorders during primary school years. Some children have documented weakness of the circumoral and other facial muscles, and it is hypothesized that those children may show an improved response to traditional speech therapy when an adjunctive exercise is added. Additionally, children with demonstrated coordination problems of these muscle groups may show improved response to speech therapy if a successful program of muscle strengthening is accomplished.

## MATERIALS AND METHODS

Subjects were students in Philadelphia non-public schools with speech services provided by CORA Services, Inc. From a total population of 1,200 children, 201 were selected as potential candidates for study based on the presence of one or more of the following criteria:

- Apraxia
- Suspected weakness and incoordination of oral-motor function
- Poor stimulability for production of early developing phonemes: /p,b,f,v,w,wh,l/
- Poor stimulability for production of 2 or more targeted phonemes.
- Poor stimulability for production of /r/.

133 of the 201 children were able to obtain parental consent. A control group of 133 children matched for age and articulation errors was created and monitored throughout the course of the study. Twelve certified speech-language pathologists participated in the study.

The treatment course lasted 8 weeks. All of the children completed articulation evaluation before and after the course of treatment. In the treatment group, children 10 years and under were given the pediatric device and children 11 years and older were given the adult version. An attempt was made to involve the parents in the initial training. The children were asked to keep daily logs of Facial-Flex® use and these were monitored by the speech pathologists.

Each child was asked to use the Facial-Flex® device for two 4-minute sessions each day. The most suitable strength of the device for each child was determined by their ability to perform 2 minutes of exercise. A strength that allowed the easy performance of 2 minutes of constant exercise was chosen. After 4 weeks of tolerated use, each child was moved to the next higher strength if it was tolerated. The daily logs required a recording of the strength of the device or weight of the elastic bands used and the number of repetitions performed in each 2-minute session.

Results were assessed by multiple methods. All of the subjects underwent articulation testing at the start and the end of the protocol period. Response to treatment was based on the subjective judgment of the treating therapist. In addition to the completed logs, each subject had their Facial-Flex® use measured at the beginning, at the halfway point (4 weeks) and at the end of the protocol. Two tests were utilized: maximal repetitions in 2 minutes and maximum amount of time in closed position.

## **RESULTS**

Of the 133 children in the treatment group, 21 were excused from the study because of non-compliance. 65 children were found to be partially compliant based on inconsistent performance of the protocol, inconsistent record-keeping with the daily log, less than 90% attendance or questioned validity of records. 47 were found to be totally compliant. Twenty-seven children (57%) completed the study with the adult device and twenty (43%) used the pediatric device. The age range of the pediatric group was 5 through 9 and the adult group was 8 through 16.

These 47 children were evaluated for response to Facial-Flex® use by examining the maximal repetition and maximal closed time tests. Each value was multiplied by the strength of resistance used in the test for an index score (repetition index (RI)) and closed time index (CTI), and the indexes were compared from the beginning and end of the protocol to determine improvement in function of the muscles undergoing repeated exercise. All of the children showed improvement in both measures. The total group showed an average of 467% improvement in RI and 224% in CTI. In the pediatric group, the smallest average improvement was 66% and the greatest was 2838%. In the adult group, the smallest average improvement was 42% and the greatest was 2100%.

Based on the results, 5 groups of disorders were determined: /r/ (46%), /r/ and /l/ (6%), lateral (3%), fricatives (11%) and multiple articulation deficits (34%). 44 of 45 (98%) of children with multiple articulation deficits had errors that included the /r/ phoneme.



There was no difference in results of the articulation tests between the study group and the control group. However, the treating speech pathologists identified 8 children who demonstrated improvement in oral facial strength as measured by both the RI and CTI. These same children also were noted to have improvement in articulation that could not be attributed to the traditional speech therapy. This group included one 7-year-old, two 8-year-olds, two 9-year-olds, a 10-year-old, an 11-year-old and a 14-year-old. The 5 older children used an adult model and the 3 younger children used the pediatric model. Seven of the children had difficulty with the /r/ phoneme as their primary articulation disorder and 1 child had primary difficulty with lateral emission on /sh/ and /ch/.

The therapists involved in the study were asked to comment on ease of use of the Facial-Flex® devices in different age groups. All the therapists reported that the pediatric device was not as effective in children 8 years old and older because it was too small. The adult device was successfully applied in many children 8 to 10 years old who had a poor fit with the pediatric model. The therapists also noted that compliance was directly related to parental involvement in both the initiation and ongoing reporting of the study.

### **DISCUSSION**

This study demonstrates safe and efficacious use of Facial-Flex® in the pediatric population. The pediatric device was easily fit in children between the ages of 5 and 8. It was presumed at the outset of the study that all children 10 years old and under would use the pediatric model, but during the study it became apparent that most children over 8 years old are better fit with the adult model. The use of both models was easily taught during a single session with the speech therapist assisted by an instructional videotape. Forty-seven subjects (35%) were totally compliant for both usage and reporting requirements of the protocol. 112 subjects (84%) were either totally or partially compliant. Only 2 subjects stopped use because of discomfort and neither had any further complaints after the use was discontinued.

Improvement in facial strength was consistent and measurable in children using both the pediatric and adult models. The parameters utilized to measure improved muscle strength, RI and CTI, more than doubled. All the subjects demonstrated improvement.

A specific benefit in treatment of articulation disorders was noted in children with /r/ phoneme difficulties. This represented the largest group in the study, and 7 children (12%) were found to improve so dramatically during the 8-week period that their therapists attributed the response to Facial-Flex® use. Another child with /sh /and /ch/ difficulties also made remarkable progress. This articulation disorder is similar to the /r/ phoneme complaint because correction requires alteration of unobservable tongue position. These findings raise the possibility that use of the Facial-Flex® will assist in teaching mid-tongue position for specific articulation problems. The presumed mechanism of this correction would involve improved oral closure and improved lip and tongue coordination as a result of improved facial muscle strength.

Future studies of Facial-Flex® will be designed to target pediatric populations with /r/ phoneme disorders and those with articulation deficits secondary to documented oral motor weakness. Additionally, with more time set aside for parent education and contact, improved compliance can be expected.

### **CONCLUSIONS**

- Facial-Flex® pediatric and adult models can be safely and effectively used in the pediatric population as young as age 5.



## CLINICAL STUDY

- Improvement of circumoral muscle strength was demonstrated after an 8-week exercise program with both the pediatric and adult models.
- Most children 8 or older will be best fit with the adult model.
- Use of Facial-Flex® may provide a significant benefit in the treatment of disorders of r/phoneme articulation and other problems associated with unobservable tongue position.